IN THE CLAIMS:

Please cancel claims 35 and 36 without prejudice or disclaimer.

1. (Previously Presented) A method of determining the phase and/or amplitude information of an electromagnetic wave

- in which an electromagnetic wave is radiated onto the surface of a photonic mixing element having at least one pixel, wherein the pixel has at least two light-sensitive modulation photogates G_{am} and G_{bm} and associated accumulation gates G_a and G_b,

- in which there are applied to the modulation photogates G_{am} and G_{bm} modulation photogate voltages $U_{am}(t)$ and $U_{bm}(t)$ which are in the form of $U_{am}(t) = U_o+U_m(t)$ and $U_{bm}(t) = U_o-U_m(t)$, wherein U_o represents a bias voltage of the accumulation gates G_a and G_b,

- wherein applied to the accumulation gates G_a and G_b is a dc voltage whose magnitude is at least as great as the magnitude of the sum of U_o and the amplitude of the modulation voltage $U_m(t)$,

- in which charge carriers produced in a space charge zone of the modulation photogates G_{am} and G_{bm} by the electromagnetic wave are exposed to a potential gradient of a drift field in dependence on the polarity of the modulation photogate voltages $U_{am}(t)$ and $U_{bm}(t)$ and drift to the corresponding accumulation gate G_a and G_b, and

- in which charges q_a and q_b which have drifted to the respective accumulation gates G_a and G_b are taken off.

2. (Previously Presented) A method according to claim 1

- in which the electromagnetic wave is irradiated by a transmitter,

- in which the electromagnetic wave reflected by an object is radiated onto the surface of the photonic mixing element,

- in which the modulation photogate voltages $U_{am}(t)$ and $U_{bm}(t)$ are in fixed phase relationship with the phase of the electromagnetic wave irradiated by the transmitter, and

- in which the charge carriers produced are additionally exposed to the potential gradient of a drift field in dependence on the phase of push-pull modulation photogate voltages $U_{am}(t)$

and $U_{bm}(t)$.

3. (Previously Presented) A method according to claim 2

- in which for two different phase shifts $\Delta\phi_1$ and $\Delta\phi_2$ of the modulation photogate voltages $U_{am}(t)$ and $U_{bm}(t)$ relative to the phase of the electromagnetic wave irradiated by the transmitter and charges q_{a1} and q_{bl} as well as q_{a2} and q_{b2} are taken off and the charge differences $(q_{a1} - q_{bl})$ and $(q_{a2} - q_{b2})$ are formed, and
- in which in accordance with the equation

$$\varphi_{opt} = \frac{q_{a2} - q_{b2}}{q_{a1} - q_{b1}}$$

the pixel phase ϕ_{opt} of the electromagnetic wave is determined relative to the phase of the electromagnetic wave irradiated by the transmitter and thus the transit time of the electromagnetic wave received by the pixel is determined.

4. (Previously Presented) A method according to claim 3

- in which by means of four modulation photogates G_{am}, G_{bm}, G_{cm} and G_{dm} and four associated accumulation gates G_a, G_b, G_c and G_d, for two different phase shifts $\Delta\phi_1$ and $\Delta\phi_2$ of the modulation photogate voltages $U_{am}(t) = U_0+U_{m1}(t)$ and $U_{bm}(t) = U_0-U_{m1}(t)$ and $U_{cm}(t) = U_1+U_{m2}(t)$ and $U_{dm}(t) = U_1-U_{m2}(t)$ relative to the phase of the electromagnetic wave irradiated by the transmitter, at the same time charges q_a, q_b, q_c and q_d are separated and taken off, and
- in accordance with the equation

$$\varphi_{opt} = \frac{q_c - q_d}{q_a - q_b}$$

the pixel phase ϕ_{opt} of the electromagnetic wave irradiated by the transmitter and therewith the transit time of the electromagnetic wave received by the pixel is determined.

5. (Previously Presented) A method according to claim 2

- in which the photonic mixing element has a plurality of pixels,

- in which at least one pixel is directly radiated with a part of the electromagnetic wave from the transmitter and

- in which calibration of the phase shift between the electromagnetic wave and modulation photogate voltages $U_{am}(t)$ and $U_{bm}(t)$ is implemented from a phase shift measured with said pixel.

6. (Previously Presented) A method according to claim 1

- in which the electromagnetic wave with independently excited, unknown intensity modulation is radiated onto the surface of the photonic mixing element,

- in which the modulation photogate voltages $U_{am}(t)$ and $U_{bm}(t)$ are produced by a tunable modulation generator,

- in which the charge carriers produced are additionally exposed to a potential gradient of a drift field in dependence on the phase of push-pull modulation photogate voltages $U_{am}(t)$ and $U_{bm}(t)$, and

- in which the photonic mixing element and the modulation generator form at least one phase-lock loop and the electromagnetic wave is measured in accordance with a lock-in method.

7. (Previously Presented) A method according to claim 1 in which a continuous or discontinuous HF-modulation is used as modulation for the electromagnetic wave, and pseudo-noise modulation or chirp modulation is used as modulation for the modulation photogate voltages.

8. (Previously Presented) A method according to claim 7 in which the modulation photogate voltage is HF-modulation and the charges q_a and q_b for the phase shifts $\Delta\phi = 0°/180°$ and $90°/270°$ are taken off.

9. (Previously Presented) A method according to claim 1 in which a steady-state modulation is used with modulation photogate voltages $U_{am} = U_o+U_{m0}$ and $U_{bm} = U_0-U_{m0}$ with a settable modulation dc voltage U_{m0} which is constant in respect of time and with which a difference image from the difference of the charges q_a and q_b is specifically weighted.

10. (Previously Presented) A method according to claim 1 in which the charges q_a and q_b beneath the accumulation gates G_a and G_b are integrated and read out with a multiplex structure.

11. (Previously Presented) A method according to claim 1 in which the accumulation gates G_a and G_b are in the form of pn-diodes, and in which the charges q_a and q_b are read out directly as voltage or as current.

12. (Previously Presented) A method according to claim 11 in which the pixel phase or the pixel transit time and the pixel brightness are ascertained directly by means of an active pixel sensor structure (APS).

13. (Previously Presented) A method according to claim 1 in which brightness of the pixel is respectively evaluated as the sum of the charges of the associated accumulation gates as a grey value image.

14. (Previously Presented) A method according to one of claims 1 to 13 characterized in that in background lighting or an external, non-modulated additional lighting, a difference between grey value images taken with and without exposure of the photonic mixing element to the electromagnetic wave is used as a correction parameter.

15. (Previously Presented) A method according to one of claims 1 to 13 characterised in that the photonic mixing element comprises a plurality of pixels used in a linear, surface or spatial array.

16. (Previously Presented) A method according to claim 15 characterised in that at least one of the pixels is directly radiated with a part of an intensity-modulated electromagnetic wave serving as lighting and that the measurement at said at least one pixel is used for calibration of other phases and brightness results, wherein reference pixel or pixels is or are acted upon by a transmitter with different levels of intensity or levels of intensity which can be differently set.

17. (Previously Presented) A photonic mixing element

- with at least one pixel (1),
- which has at least two light-sensitive modulation photogates (G_{am}, G_{bm}) ~~and~~ comprising terminals for and adapted to receive modulation photogate voltages $U_{am}(t)$ and $U_{bm}(t)$ which are in the form of $U_{am}(t) = U_o+U_m(t)$ and $U_{bm}(t) = U_o-U_m(t)$, and
- accumulation gates (G_a, G_b) which are associated with the modulation photogates (G_{am}, G_{bm}) and which are shaded relative to an incident electromagnetic wave, wherein U_o represents a bias voltage of the accumulation gates (G_a ,G_b).

18. (Original) A mixing element according to claim 17 characterised in that a middle gate (G_o) is arranged between the modulation photogates (G_{am}, G_{bm}).

19. (Previously Presented) A mixing element according to claim 17 characterised in that the at least one pixel (1) has four, symmetrically arranged, modulation photogates (G_{am}, G_{bm}, G_{cm}, G_{dm}) and accumulation gates (G_a, G_b, G_c, G_d).

20. (Previously Presented) A mixing element according to one of claims 17 to 19 characterised in that the accumulation gates (G_a, G_b) are in the form of pn-diodes, and the charges q_a, q_b can be read out directly as voltage or current.

21. (Previously Presented) A mixing element according to claim 17 characterised in that for the purposes of increasing a maximum modulation speed the pixel is produced using buried channel GaAs-technology and with an integrated drift field.

22. (Previously Presented) A mixing element according to claim 17 characterised in that the at least one pixel (1) is in the form of an active pixel sensor structure with partially pixel-related signal processing and partially line- or matrix-related signal processing.

23. (Previously Presented) A mixing element according to claim 17 characterised in that the shading is also extended onto edge regions of the modulation photogates.

24. (Previously Presented) A mixing element arrangement having at least two photonic mixing elements according to claim 17 characterised in that the photonic mixing elements are arranged in a one-dimensional, two-dimensional or three-dimensional arrangement.

25. (Original) A mixing element arrangement according to claim 24 characterised in that modulation photogates ($G_{am,n}$, $G_{am,n+1}$) and ($G_{bm,n}$, $G_{bm,n+1}$) respectively associated with two adjacently arranged, different pixels (n, n+1) respectively have a common accumulation gate (G_s) and that the modulation photogates ($G_{am,n}$, $G_{am,n+1}$) and (G_{bm}, $G_{bm,n+1}$) respectively are acted upon by the same modulation photogate voltages $U_{am}(t)$ and $U_{bm}(t)$.

26. (Previously Presented) A mixing element arrangement according to claim 24 characterised in that there are provided devices for direct irradiation of the at least one pixel (1) as a reference pixel, by means of which a part of the incident electromagnetic wave emitted by a transmitter is directed onto the at least one pixel.

27. (Original) A mixing element arrangement according to claim 26 characterised in that the devices for direct irradiation are equipped for a variation in respect of space and/or time of the intensity of the direct irradiation.

28. (Previously Presented) A one-dimensional or multi-dimensional mixing element arrangement according to claim 24 characterised in that the at least one pixel (1) are embodied using MOS-technology on a silicon substrate (2) and can be read out with a multiplex CCD-structure.

29. (Previously Presented) A mixing element arrangement according to claim 24 characterised in that there is provided a microlens optical system which produces substantially for each mixing element used for image recording its own microlens by which the incident electromagnetic wave is focussed onto a central region of the mixing element which can thus be reduced in size.

30. (Previously Presented) Apparatus for determining phase information of an electromagnetic wave

- having at least one photonic mixing element comprising:
  - at least one pixel (1),
  - which has at least two light-sensitive modulation photogates (G_{am}, G_{bm})

comprising terminals for and adapted to receive modulation photogate voltages $U_{am}(t)$ and $U_{bm}(t)$ which are in the form of $U_{am}(t) = U_o+U_m(t)$ and $U_{bm}(t) = U_o-U_m(t)$,

- accumulation gates (G_a, G_b) which are associated with the modulation

photogates ($G_{am,}$ G_{bm}) and which are shaded relative to an incident electromagnetic wave, wherein U_o represents a bias voltage of the accumulation gates G_a and $G_{b,}$ and

- having a modulation generator (10, 13), and
- having a transmitter (4) that irradiates the electromagnetic wave which is intensity-modulated by the modulation generator (10, 13) in predetermined manner,
- wherein the electromagnetic wave which is reflected by an object (6) is radiated onto the surface of the photonic mixing element, and
- wherein the modulation generator (10, 13) supplies the photonic mixing element with modulation voltages $U_m(t)$ which are in a predetermined phase relationship with respect to the phase of the electromagnetic wave that is irradiated from the transmitter.

31. (Previously Presented) Apparatus according to claim 30 characterised in that there are provided an optical system (7) and a mixing element arrangement, wherein the optical system (7) forms an image of the reflected electromagnetic wave that is radiated onto the surface of the photonic mixing element.

32. (Previously Presented) Apparatus according to claim 30 or 31 characterised in that there are provided a mixing element arrangement with associated optical receiving system, electronic evaluation and signal processing system for difference signals, sum signals and reference signals, with a digital memory for a grey value image and a transit time or distance image, a transmitter for lighting a three-dimensional scene with modulated electromagnetic waves, and with an adjustable optical transmitting system corresponding to the optical receiving system, forming a digital 3D-photographic camera in the form of a compact unit.

33. (Previously Presented) Apparatus according to claim 30 or 31 characterized in that to form a digital, three-dimensionally recording video camera, there are provided mixing element arrangement with associated optical receiving system, electronic evaluation and signal processing system for the difference signals, sum signals and reference signals, with a digital memory for a grey value image and a transit time or distance image, a transmitter for lighting a three-dimensional scene with modulated electromagnetic waves, and with an adjustable optical transmitting system corresponding to the optical receiving system, wherein there are further provided memory means for storage of digital image sequences.

34. (Previously Presented) Apparatus according to claim 32 characterised in that the transmitter is provided with devices for emitting light waves in various spectral regions for producing colour images or colour image components.

35. Canceled

36. Canceled

37. (Previously Presented) A method according to claim 8 in which the charges q_c and q_d are taken off.

38. (Previously Presented) A method according to claim 10 in which the charges q_a and q_b beneath the accumulation gates G_a and G_b are integrated and read out with a CCD-structure.

39. (Previously Presented) A method according to claim 11 in which the charges q_c and q_d are read out directly as voltage or as current.

40. (Previously Presented) A method according to claim 11 in which the pn-diodes are blocked, low-capacitance pn-diodes.

41. (Previously Presented) A method according to claim 11, in which the structure is made in CMOS technology.

42. (Previously Presented) A method according to claim 12 in which the pixel phase or the pixel transit time and the pixel brightness are selectively and/or serially read out by way of an on-chip multiplex structure.

43. (Previously Presented) A mixing element according to claim 20 characterised in that the charges q_c, q_d can be read out directly as voltage or current.

44. (Previously Presented) A mixing element according to claim 20 in which the pn-diodes are blocked, low capacitance pn-diodes.

45. (Previously Presented) A mixing element according to claim 20 in which the pn-diodes comprise CMOS technology pn-diodes.